Joint Fire Science Program Science Delivery and Application Strategy

Why should there be a strategy?

The Joint Fire Science Program's (JFSP) mission is to find solutions to the problems faced by those who manage fire-prone forests and rangelands. In fulfilling this mission, the JFSP has generated a substantial volume of new knowledge, methods, and tools related to fire, fuels, and human interactions. There is, however, no organized system to bring them in to use. Through this strategy, the JFSP Governing Board wants to move from the current ad hoc method of science delivery and application to a more systematic process. We want to engage our customers in mutually beneficial partnerships that interactively address their problems instead of trying to entice them to adopt our ideas. This strategy is about how to develop and manage these partnerships. A companion Science Delivery and Application Implementation Plan describes the specific tactics the Governing Board will use to accomplish the strategic goals described here.

The strategy recognizes the eight strategic program areas mandated by Congress, which form the foundation of the JFSP's mission:

- Fuel inventory and mapping
- Effects of fuel treatments
- Scheduling of fuel treatments
- Monitoring and evaluation
- Post-fire stabilization and rehabilitation
- Remote sensing approaches for wildfire and fuels research
- Rapid response projects
- Local needs of managers

Projects funded by JFSP use a variety of approaches to develop new information and tools. These include replicated experiments, development and testing of new approaches for monitoring (such as remote sensing), rapid response research to obtain time-critical information during or immediately after wildfires, retrospective studies, landscape and stand-level research and tool development, laboratory research, synthesis of existing information, and development of new or enhanced models and decision support tools.

To advance the ability of JFSP to effectively set priorities and meet the needs of users in these strategic program areas, we will develop partnerships with managers through four broad types of research, development, and application activities:

- Synthesize the existing state-of-the-art knowledge
- Conduct new research
- Validate existing research through field trials
- Develop applications and analysis tools

What will the strategy do?

This strategy describes how the Governing Board can successfully bring JFSP-sponsored tools and information into use by the fire and natural resource management communities. **The five Strategic Objectives of the Science Delivery and Application Strategy are:**

1. Evaluate and expand the JFSP's customer base and develop interactive tactics to reach specific customer groups.
2. Work with our customers to develop an effective problem-framing process that identifies topics for science delivery and applications activities and prioritizes them over the short term (for existing studies) and long term (for future studies).
3. Engage our customers to determine the mix of products we need to present to different groups and individuals.

4. Explore ways that scientists and managers with different skills, backgrounds, and personalities can effectively contribute to the science applications process.
5. Establish methods to describe, monitor, and measure success through customer feedback and input.

Understanding our customer base

Objective 1 Evaluate the JFSP's customer base and develop tactics to reach specific customer groups.

Who are our customers?

Our customers include individuals, at all administrative levels, who are charged with finding ways to plan for and manage wildland fire, and its impacts on human communities, ecosystems, and the environment. This goes well beyond those who actually fight fire to include a variety of administratively distinct groups of customers such as federal, state, and local governments; non-governmental organizations and corporations. Although they represent a wide range, we can broadly categorize our customers into five groups. Members of each group need to know something different about the JFSP's products or activities. Sometimes they need to know different things about the same product or receive information in different ways

1. We consider **managers** the ultimate consumers of the JFSP's products. At all levels in government and private organizations, they are responsible for fighting wildfires and managing the ecosystems where wildfires occur. The largest group of managers includes the GS7 to GS15 specialists and line officers who plan and implement activities associated with wildfire and natural resource management on federally administered land, and their counterparts who manage state and private lands. These managers want information and tools that are appropriate

for their level of technical expertise and that will help them to do their jobs more easily or effectively.

2. Managers, or other customer groups, are often represented by those who we think of as **clients**. Clients are individuals or groups who interact closely with the JFSP or its agents (e.g., Study Principal Investigators). By representing different customer groups clients help the JFSP to understand the specific needs of those groups.

3. **Partners** are groups or individuals who devote funding or other resources to accomplish work supported by the JFSP. Partners generally have specific agendas. When we work with them we must develop techniques to assure them that their needs are adequately addressed. Creative interactions with partners help us to accomplish more with our limited resources.

4. Federal, state, and private **policymakers** use information generated by the JFSP to inform the decisions they make about wildfires and related issues. Our interactions with policymakers are important because they can both mandate the implementation of our products, and advocate for us. We must manage interactions with policymakers in ways that are mutually beneficial.

5. **Congress** sponsors the program by providing both its mandate and its funding. Members of Congress need to know what the program has accomplished, that its products are being used, and that they are making a difference in the field. Members of the other four customer groups can help members of Congress and their staffs understand what JFSP has accomplished.

Making connections to our customers

To effectively interact with our customers we recognize that different people acquire information in different ways and a given individual will seek the same piece of information using different information channels depending upon the

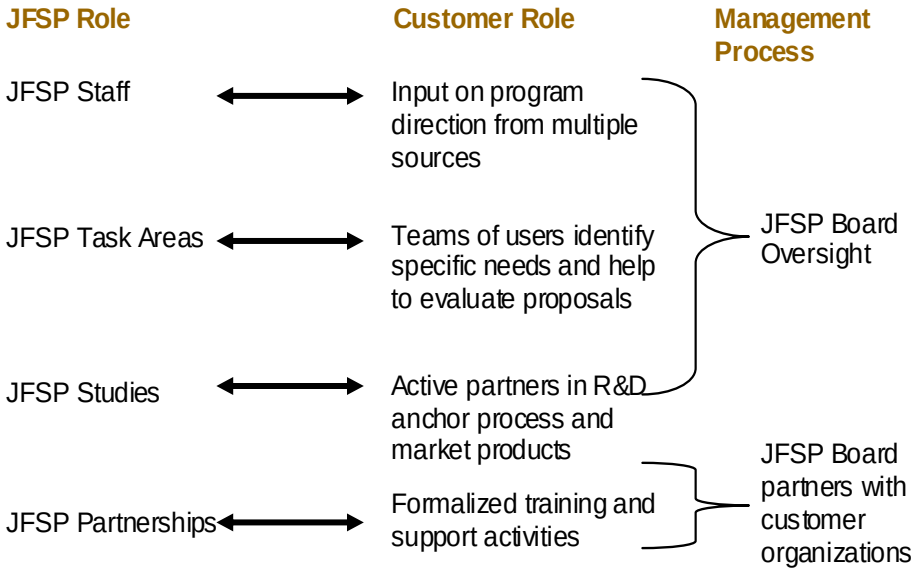
circumstances. For this reason we want to create an "information smorgasbord" where customers can select the information channel that best suits their needs at a particular point in time. Some examples are: one-on-one contact, formal training either in person or through distance learning techniques, traditional research papers, summaries and syntheses, web-based information engines, workshops, scientific conferences, site visits, or visiting scientist programs. Over the first two years of this strategy, we will establish a program to evaluate our existing delivery methods, through surveys of agency personnel, formal interviews and discussions with individual and groups of users, and by reviewing records of use of JFSP products in formalized training sessions. We will also try a variety of new delivery methods and use these methods to similar evaluation methods to track their success. We will then adapt our program to use the most effective delivery and evaluation methods.

Clients and partners create a connection to other customers

We believe that our customers are the best advisors, advocates, and marketers of our work. We want them to help us fulfill our primary mandate of giving managers access to the most up-to-date scientific and technical information possible. We believe customer participation is an essential part of building a successful program.

A conceptual model of customer involvement in shaping and delivering the JFSP program of work is depicted in Figure 1. This figure outlines four primary activities where customers' participation is actively sought: 1) identification of needs for new or better information and tools, 2) prioritization and selection of topics for study, 3) generation of new information or creation of new tools, and 4) managing the diffusion of either tools or information to those who need them.

Figure 1. Customer participation shapes our program of work and enhances marketing of our products.



Our Science Delivery and Application Strategy recognizes that we cannot successfully enhance application of new information and tools without the active involvement and participation of our customers. Only a small fraction of our customers can actively participate, so we are careful to devote our scarce resources to working with the individuals and groups that are most effective in alerting us to customer needs and helping to promote our products to our customers.

Framing problems

Objective 2 Work with our customers to develop an effective problem-framing process that identifies topics for science delivery and applications activities and prioritizes them over the short term (existing studies) and long term (future studies).

We believe that the most critical step of the research, development, and application process is to correctly frame the problem. Therefore, we will devote considerable effort to working with our customers to ensure that we understand their information needs and have correctly prioritized them. We will find ways to appropriately engage representatives of each customer group in assessment of needs, selection and design of studies, and interpretation and application of results. We also want to include scientists in this process because we recognize that people who are actively dealing with problems sometimes fail to view them in the same light as outsiders and they may have difficulty seeing problems on the horizon. By involving a variety of views in these in the problem framing phase we also hope to develop synergy for interdisciplinary solutions.

In the 1970s and 1980s many government research laboratories around the world were "privatized." Those that survive today have common elements in the way they involve customers in their activities and we can learn from their successes and failures. Successful elements these organizations seem to share are in the ways they manage the customer input process, identify and encourage champions, and interact with clients or partners to guide major lines of work. We will build on these existing successful models to gather information and adjust what we do through an adaptive process.

Efficiently gathering customer input

"Customer technical committees" are a proven technique to identify areas of common interest, establish customer contacts for studies, provide guidance of work, and participate in the delivery and application of products. These committees create a sense of ownership on the part of customers and provide the JFSP with a way to connect directly with customers. The JFSP has experimented with such committees through our Stakeholder Advisory Group. This group functioned under a two year charter and suggested several topics for AFPs. We have learned that such groups need a narrow focus and specific tasks to be truly effective. Under this strategy we will establish technical

committees when we want to identify potential new lines of work or gather information on customer needs regarding established lines of work.

Topical advocates manage major lines of work

The US Navy has established a network of Fleet Science Advisors who are technical experts on a class of ship, e.g., the Nimitz class aircraft carrier. These specialists evaluate existing technology and advocate for new technologies that are needed for the class of ship they represent. On the JFSP Governing Board, each board member plays a similar role by representing a particular DOI agency or branch of the Forest Service. Each one provides input about the needs of the sector they represent. We will expand this model to include individuals who work closely with Governing Board members to provide information on specific broad programmatic areas, e.g., fire behavior modeling, the environmental effects of fire hazard reduction treatments, training programs, etc. The role of these "topical advocates" is to gather information from the customer group they represent, provide information to the Governing Board about needs, and monitor progress and effectiveness.

Nurturing champions

A similar technique is the use of formalized interactions with customers at the study level. Champions are people who advocate for particular products and both enthusiastic about a particular project or idea and are effective in garnering support within their organization. We will nurture champions and attempt to associate one or more champions to every major study or group of smaller studies. They will play two roles: (1) they will inform us of how to best shape a study so that it is meaningful to the customer group they represent, and (2) they will help us market products from that study to our customers.

Tailoring science delivery and applications over the short and long terms

The JFSP has accomplished much since its inception in 1998. Over 300 studies have been initiated and they have generated a great deal of new information. A

substantial science delivery activity was required as part of each of these studies but we now recognize that successful science application requires a combination of strategies and a more coordinated approach in addition to study-centric approaches, We are in the process of evaluating the portfolio of information and tools generated by these existing studies, so we can synthesize it into more cohesive messages that address our eight strategic program areas, compile materials for established training programs, sponsor topical workshops, and evaluate tools through field trials.

As we move into the future, we will be more deliberate about linking our problem-framing activities to our science delivery and applications activities. This will allow us to develop a science delivery and applications plan at the time we institute a new line of work, not tack it on at the end. We will purposefully consider science delivery in all phases of the work so that investigators will understand who they are developing information or designing tools for, when those products are expected, and how customers will use them. How science delivery is incorporated into lines of work will depend on the skills and interests of those who perform the work. In some cases the investigators themselves may perform this task and in others science delivery specialists may do it. In all cases, we will structure our lines of work to deliver known products to specific groups within strict timelines. The JFSP Governing Board will focus more on selecting and managing lines of work rather than on individual studies. This will allow us to become more deliberate in the way we think about coordinating and integrating individual studies to accomplish the broad tasks we identify in collaboration with our customers.

Manage the delivery process

Objective 3 Engage our customers to determine the mix of products we need to present to different groups and individuals.

JFSP is faced with a variety of customers needs. Some need information and tools to address issues directly related to on the ground management or planning, while others need to inform the policy formulation process.

Understanding our customers' organizations helps us select a tactic

The number of agencies and organizations we serve complicates our task because they are all somewhat different and tactics that work for one group could be counterproductive for another. The Department of Interior is the most variable with five agencies each looking for something different from the JFSP. Reaching BIA customers will probably require highly personalized and verbal approaches while reaching BLM customers will require recognition of the state by state organizational structure. The National Park Service needs alternatives that are compatible with the mandate to maintain as natural a setting as possible. The Fish and Wildlife Service has dual requirements for information geared toward consultation on one hand and active management of wildlife refuges on the other. USGS scientists need ways to rapidly apply new information as they design studies to build on emerging knowledge.

The Forest Service is probably the most structured of the JFPS customer organizations but there is also a high level of local autonomy within the agency. We can harness both of these attributes to work for us, because we recognize that diffusion of new ideas happens both through bottom-up and top-down processes. The hybrid found in the Forest Service offers opportunities to test methods to use different innovation adoption processes.

For example, in situations where consistency or safety is important it might be efficient to work downward through organizations during the implementation phase. On the other hand, in situations where consistency and safety are less important, more of a bottom-up approach could lead to greater reinvention and, therefore, a deeper level of acceptance of the innovation. When following this

strategy we will take a deliberate look at the best tactics to use to implement each innovation.

Using existing organizations to accomplish more

Whenever possible we will use existing science delivery and applications organizations rather then create new ones. A few examples of such organizations are the Forest Service's State and Private Cooperative Programs unit, the Cooperative Extension Study Units sponsored at universities by the National Park Service, federal and state sponsored training programs, extension programs at forestry universities, and existing science delivery units and specialists within the FS and DOI agencies. We will leverage our outreach activities through these organizations so that we do not have to build all of the necessary capability ourselves. This will also allow us the flexibility to form and end relationships as appropriate without establishing a permanent workforce within the JFSP.

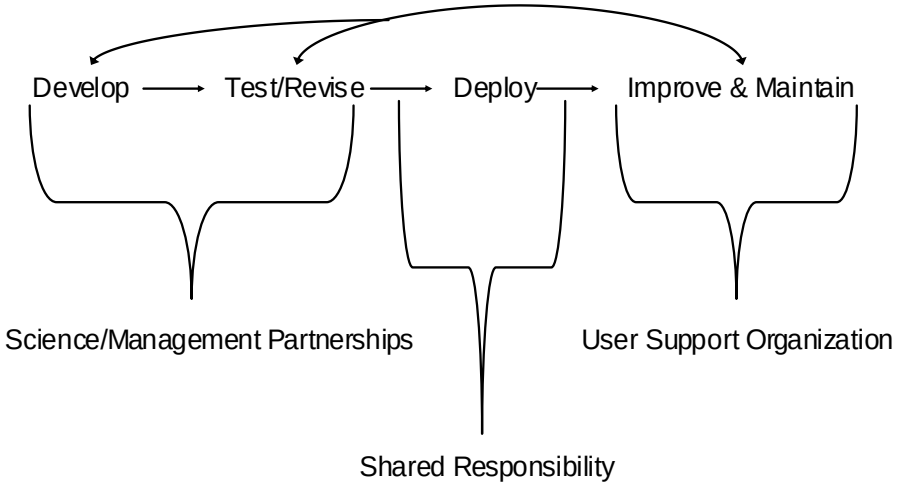
A specific example of how we can use existing organizational capacity is through the rudimentary science delivery network that already exists within the Forest Service. Each Forest Service Region has a hierarchical network of specialists who sometimes share scientific and technical information. Under this system, regional specialists can act as change agents for forest level specialists who in turn can act as change agents for district level specialists. By deliberately engaging these specialists we can begin the downward flow of new scientific information and perhaps encourage the upward flow of information needs. We can study this information channel, determine if it is effective, and then consider instituting a similar model in other agencies.

Using personnel data to guide the delivery process

One situation that is particularly vexing for both the JFSP Governing Board and JFSP customers is how to make decisions about what modeling systems to develop and deploy, and once they are deployed who should take responsibility

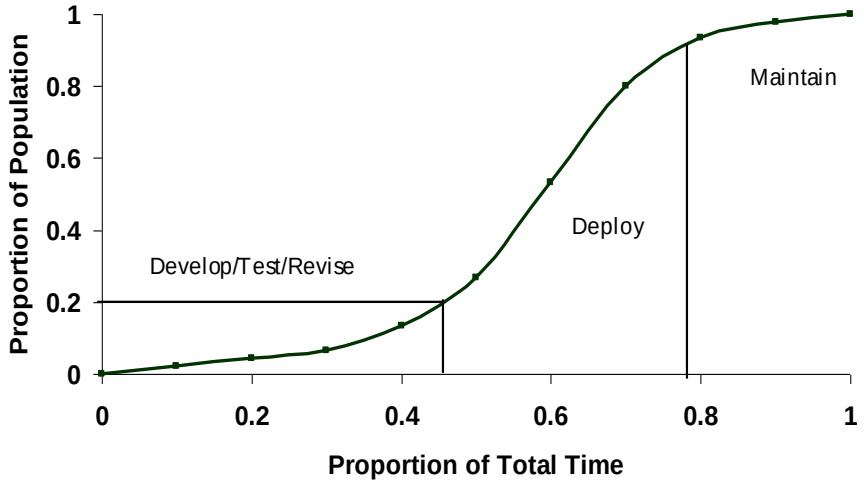
for maintaining them. A conceptual model for how the handoff from research to management for these tools could occur is shown in Figure 2.

Figure 2. A conceptual model for the handoff of responsibility as new tools are developed, deployed, and maintained.



The federal agencies associated with the JFSP are unique in that it is often possible to identify precisely which specialties should adopt a new tool and how many staff members belong to each specialty. This provides a splendid opportunity to use the concept of an adoption curve to both manage the handoff and test one of the fundamental pillars of Innovation Diffusion Theory. A typical adoption curve is shown in Figure 3. Innovation Diffusion Theory holds that the rate of adoption accelerates rapidly once a critical number of managers adopt an innovation. That number is generally between 10 and 20% of the total manager population. The problem with this theory is that it is difficult to test because we almost never know how many people will adopt a particular innovation. Accordingly adoption curves are almost universally constructed retrospectively and used to explain the process rather than to predict it.

Figure 3. Adoption curves can guide handoff from research to user support.



Our ability to estimate how many managers we expect to adopt an innovation will allow us to use adoption curves in a prospective rather than retrospective way. The three distinct zones shown in Figure 3 are (1) developing, testing, and debugging the tool; (2) deploying the tool and training staff to use it; and (3) routine service and maintenance. We can use the conceptual model shown above in Figure 2 to manage the transitions from one zone to the next and hand off responsibility for funding various activities.

Controlling the deployment of tools speeds the adoption process

Developing models is an essential step in demonstrating that scientists have a functional understanding of how the processes we want to manage work but managers are distracted when they are confronted with a constant stream of new models. By becoming more deliberate about identifying and focusing on specific

lines of work, the JFSP Governing Board hopes to encourage modeling activities as a way to demonstrate and develop understanding of processes and identify knowledge gaps while limiting the number of new "tools" based on those models that reach managers.

Once we have established the need for a new tool, we will function in much the same way the military does when it begins development of a new weapons system. We will work in collaboration with our customers (the ultimate users of the tool) to develop and test prototypes, perhaps sponsoring competitions among different research groups, where we clearly state specifications for the new tool. Following the conceptual model shown in Figure 2 we can systematically step through a process to move from the recognition of a need to the deployment of a tool. We can use the process depicted in Figure 3 to manage the process and assign responsibility for the various stages of the process. By gaining agreement that a new tool is needed before we start this process we can substantially speed the time from initiation to completion and greatly reduce confusion about which tools are sponsored corporately and which are not.

Make participation attractive

Objective 4 Explore ways investigators and managers with different skills, backgrounds, and personalities can effectively contribute to the science delivery and applications process.

We want investigators to actively participate in the science delivery and applications process but it is not realistic to expect that every investigator will participate in the same way. Our experience so far is that we can mandate that each study include a technology transfer plan, but the content of those plans and the way they are implemented is highly variable. This is partially because of investigators' perceptions about their reward systems and partially because of differences in interests, expertise in and understanding of effective science

application approaches among investigators. We do not want to create a situation where only the investigators who enjoy actively working with managers apply for funding under our Announcement for Proposals (AFPs). Our experience shows that some investigators who are not good at science delivery activities are very creative in other ways and we want to continue their participation in the JFSP.

As an alternative we will use a variety of ways to encourage investigators to participate in the science delivery and applications process. For example, not all investigators want to develop training materials or teach classes, but many enjoy participation in small workshops where they can discuss their work with managers in a more relaxed setting. By sponsoring these types of workshops and recording the interactions between investigators and managers we can use the information discussed to develop training materials for use by science delivery specialists. In a similar vein, many investigators enjoy participation in formal conferences. In recent years, streaming video has proven an effective way to record what happens at those conferences and make the content available to a wide audience. We will also explore the concept of a visiting scientist program where one or more scientists spend from a day to a few months working directly with a field unit to solve a commonly encountered problem. The result of the interaction will be recorded and made available to other units with similar problems.

We also need to find ways to stimulate managers to participate in the science delivery and applications process. Throughout this strategy we have discussed ways to bring a greater level of customer involvement to the JFSP. Including a relatively small number of highly motivated customers in outreach activities is quite a different thing from trying to convince managers who already feel overworked to explore new ways to do their jobs. We are currently studying the attitudes of managers in an attempt to understand what motivates them to try

new things. We will incorporate the findings of this work into our Science Delivery and Applications Implementation plan.

In conclusion, we reiterate that the primary measure of success and credibility of JFSP research is its usefulness to practitioners. **In fact, the continued existence of the program depends on the application of our products.** By developing a program that allows investigators and managers to explore effective avenues of science delivery and applications, we believe we will break the dam that currently exists between some members of the research and management communities.

Measuring success

Objective 5 Establish methods to describe, monitor, and measure success through customer feedback and input.

Measuring our success helps us to fine tune our program of work. We think of the JFSP in much the same way a corporation might think of a brand, and we want to develop a reputation for being effective and reliable – trusted as the first source for credible fire science information. The science delivery and application strategy will be successful when:

- **The JFSP outputs are relied on by** a broad class of information users who need fire related research to support sound decisions.
- **Our customers know when they are using JFSP products** and anticipate delivery of new products or tools rather than skeptically tolerating our marketing efforts.
- **Our customers seek us out** to develop new tools or solve technical problems because they know JFSP will engage the most qualified scientists and developers to solve their problems.
- **Our customers actively support the program** to decision makers within and outside their agencies or organizations.

To make these measures meaningful and measurable we need to find ways to quantify them. We are fortunate, because determining the number of people and organizations we serve is a relatively straightforward process. In the federal system, we can determine exactly how many GS-7/9 fuels specialists there are, for example, and then measure how many of them know about or use specific products. At the state level we know how many state fire and forestry organizations there are, how many employees they have in what job categories, and again we can measure their use of our products. We know the number of Native American tribes that might use our products and so on.

In summary, we will measure our success by establishing who our customers are and then involving them in developing priorities and plans for JFSP-funded activities, delivering the results, and monitoring their application and use. We will develop metrics to track the rate at which JFSP products are adopted and demonstrate who uses them. For example, we can track how often JFSP funded publications are cited in agency environmental documents, how many agency personnel use analytical tools developed by JFSP investigators, and how much JFSP derived information is used in agency sponsored training classes.